Notice No.2

Rules and Regulations for the Classification of Naval Ships, January 2019

The status of this Rule set is amended as shown and is now to be read in conjunction with this and prior Notices. Any corrigenda included in the Notice are effective immediately.

Please note that corrigenda amends to paragraphs, Tables and Figures are not shown in their entirety.

Issue date: June 2019

Amendments to	Effective date	IACS/IMO implementation (if applicable)
Volume 2, Part 2, Chapter 1, Section 1	1 July 2019	1 July 2019
Volume 2, Part 2, Chapter 1, Sections 2 & 7	1 July 2019	N/A
Volume 2, Part 4, Chapter 5, Section 4	1 July 2019	N/A
Volume 2, Part 7, Chapter 1, Section 5	1 July 2019	N/A
Volume 2, Part 7, Chapter 2, Section 10	1 July 2019	N/A
Volume 2, Part 7, Chapter 3, Section 9	1 July 2019	N/A
Volume 2, Part 7, Chapter 5, Section 2	1 July 2019	N/A
Volume 2, Part 8, Chapter 1, Section 18	1 July 2019	N/A
Volume 2, Part 9, Chapter 1, Sections 1 & 2	1 July 2019	N/A
Volume 2, Part 9, Chapter 3, Sections 4 & 6	1 July 2019	N/A
Volume 2, Part 9, Chapter 4, Section 4	1 July 2019	N/A
Volume 2, Part 9, Chapter 12, Section 1	1 July 2019	N/A

Lloyd's Register

Volume 2, Part 2,
Chapter 1
Reciprocating Internal Combustion Engines

■ *Section 1*
General requirements

1.2 Scope

1.2.3 Arrangements for gas only or dual fuel engines will be specially considered. For the requirements for trunk piston internal combustion engines supplied with low pressure (less than 1 MPa) natural gas (methane) as fuel, *see Rules and Regulations for the Classification of Ships, July 2018, incorporating Notice No. 1, 2, 3, 4 & 5 Pt 5, Ch 2, 15 Engines supplied with low pressure gas*.

■ *Section 2*
Materials and components

2.2 Testing and inspection

2.2.1 Materials and components for engines are to be manufactured, tested and documented in accordance with ~~the relevant requirements of the *Rules for the Manufacture, Testing and Certification of Materials, July 2018, incorporating Notice No. 1* and~~ *Table 1.2.1 Summary of testing and associated documentation for engine components* under a quality control system that is suitable for the actual engine types to be certified by LR. *See also* the applicable requirements specified in the *Rules for the Manufacture, Testing and Certification of Materials, July 2018, incorporating Notice No. 1*.

2.2.5 The manufacturer is not exempted from responsibility for any relevant tests and inspections of those parts for which documentation is not explicitly requested by LR. Manufacturers are to be equipped in such a way that all materials and components can be consistently produced to the required standard. This includes production and assembly lines, machining units, special tools and devices, assembly and testing rigs as well as all lifting and transportation devices.

(Part only shown)

Table 1.2.1 Summary of testing and associated documentation for engine components

Part	Material properties *see* Note 2	Non-destructive examination	Hydraulic testing *see* Note 4	Dimensional inspection *see* Note 3	Visual inspection	Applicable to engines	Final document to be issued
Bolts and studs for cylinder heads, crossheads, main bearings and connecting rods *see* Note ~~9~~8	W (C + M)	W (UT + CD)	-	TR [thread making for connecting rods]	-	B>300mm	W Material Properties Certificate W Non-Destructive Examination Report W Test Report
Tie rod *see* Note ~~10~~9	W (C + M)	W (UT + CD)	-	TR [thread making]	LR(V) (Random)	Crosshead	LR Component Certificate
High pressure fuel injection system – valve and pump body (pressure side) *see* Notes ~~11 and 12~~ 10 and 11	~~LR(C + M)~~ ~~*see* Note 8~~ -	-	W (Lesser of P or p+30 MPa)	-	-	B>300mm	~~LR Component Certificate *see* Note 8~~ W Hydraulic Test Certificate or Test Report
			TR (Lesser of P or p+30 MPa)			B≤300mm	
High pressure fuel injection pipes including common rail *see* Note ~~11~~10	~~LR(C + M)~~ ~~*see* Note 8~~ W (C + M)	-	W (Lesser of P or p+30 MPa)	-	-	B>300mm	~~LR Component Certificate *see* Note 8~~ W Material Properties Certificate
			TR (Lesser of P or			B≤300mm	

			p+30 MPa)				W Hydraulic Test Certificate or Test Report
High pressure common servo oil system	~~LR(C + M)~~ ~~*see* Note 8~~ W (C + M)	-	W (Lesser of P or p+30 MPa)	-	-	B>300mm	~~LR Component Certificate *see* Note 8~~ W Material Properties Certificate W Hydraulic Test Certificate or Test Report
			TR (Lesser of P or p+30 MPa)			B≤300mm	
Coolers, both sides *see* Note ~~13~~12	~~LR(C + M)~~ ~~*see* Note 8~~ W (C + M)	-	W (P)	-	-	B>300mm	~~LR Component Certificate *see* Note 8~~ W Material Properties Certificate W Hydraulic Test Certificate
Accumulator of common rail fuel or servo oil system	~~LR(C + M)~~ ~~*see* Note 8~~ W (C + M)	-	W (Lesser of P or p+30 MPa)	-	-	Accumulators with a capacity >0,5l	~~LR Component Certificate *see* Note 8~~ W Material Properties Certificate W Hydraulic Test Certificate
Piping, pumps, actuators, etc., for hydraulic drive of valves, if applicable	~~LR(C + M)~~ ~~*see* Note 8~~ W (C + M)	-	W (P)	-	-	>800kW/cylinder	~~LR Component Certificate *see* Note 8~~ W Material Properties Certificate W Hydraulic Test Certificate
Engine-driven pumps (oil, water, fuel, bilge)	~~LR(C + M)~~ ~~*see* Note 8~~ -	-	W (P)	-	-	>800kW/cylinder	~~LR Component Certificate *see* Note 8~~ W Hydraulic Test Certificate
Bearings (main, crosshead, and crankpin) *see* Note ~~14~~13	TR [C]	TR [UT]	-	W	-	>800kW/cylinder	TR Material Properties TR Non-Destructive Examination Report W Inspection Certificate

~~Note 8. Where piping systems and components are categorised as Class III, the testing for material properties shall be W(C + M) as a minimum. For materials documentation requirements, *see Pt 7, Ch 1, 4 Materials.* W Hydraulic Test Certificate or Test Report will also form as part of Final Document to be Issued.~~

Existing Notes 9 to 14 have been renumbered 8 to 13.

7.3 Auxiliary engine governors

7.3.5 For alternating current installations, the permanent speed variations of the machines intended for parallel operation are to be equal within a tolerance of ±0.5 per cent. Momentary speed variations with load changes in accordance with *Vol 2, Pt 2, Ch 1, 7.3 Auxiliary engine governors 7.3.1* are to return to and remain within one per cent of the final steady state speed. ~~Where there are no stated electrical power supply requirements for a particular installation, this should normally be accomplished within five but in no case more than eight seconds~~. This is to be accomplished within a maximum of 5 seconds; longer durations are subject to consideration by LR and are to be supported by an engineering and safety justification. For quality of power supplies, *see Vol 2, Pt 9, Ch 1, 2.1 Quality of power supplies (QPS).*

7.4 Additional requirements for auxiliary engine governors for naval vessels

7.4.2 Specific electrical power supply requirements for a particular installation as specified in the System Operational Concept, ELS Notation or by the Naval Administration are to be applied in addition to the requirements of *Vol 2, Pt 2, Ch 1, 7.3 Auxiliary engine governors 7.3.5. See also Vol 2, Pt 9, Ch 1, 3 Quality of power supplies – ELS Notation.*

Volume 2, Part 4,
Chapter 5
Electrical Protection

■ *Section 4*
Electric propulsion systems

4.3 Power requirements

4.3.9 Total harmonic distortion of the a.c. voltage waveform up to 10 per cent on electric propulsion circuits, not directly connected to the main source of electrical power, may be considered where details are submitted which demonstrate that the equipment and systems are capable of operating under such conditions. Where a higher value of THD is specified, *see Vol 2, Pt 9, Ch 1, 2.1 Quality of power supplies 2.1.4*.

4.5 Harmonic filtering for propulsion

4.5.1 The requirements in this Section apply to systems provided with harmonic filters and are in addition to the requirements for harmonic filters in *Vol 2, Pt 9, Ch 3, 4.11 Harmonic filtering* and *Vol 2, Pt 9, Ch 4, 4.13 Harmonic filters*.

~~4.5.2 Where line filters are used to keep harmonic distortion within acceptable limits, the filter layout shall be designed for any conceivable line, generator and load combinations. *See also Vol 2, Pt 4, Ch 5, 4.3 Power requirements 4.3.9*.~~

~~4.5.3~~ 4.5.2 In the event of filter circuit failure, continued safe operation of the propulsion system is to be possible by following appropriate procedures, as specified by the manufacturer and/or system integrator. These procedures are to include any operational limitations, and they are to be kept on-board and made available to the Surveyor on request.

~~4.5.4 The service life of the harmonic filter is to be declared, and details are to be made available to the Surveyor on request.~~

~~4.5.5 Where parallel filter circuits are to be used;~~

~~(a) the current imbalance is to be monitored; and~~

~~(b) an alarm is to be initiated when the imbalance level could lead to filter failure.~~

~~4.5.6 The temperature rating of the harmonic filter is to allow for the increased heating effect of the harmonic distortion, and to be tested during sea trials~~

~~4.5.7 The construction of cabinets for harmonic filters shall be in accordance with the standards for main switchboards, where applicable. *See also Pt 6, Ch 2, 7 Switchgear and controlgear assemblies*.~~

Volume 2, Part 7,
Chapter 1
Piping Design Requirements

■ *Section 5*
Pipe joints

5.2 Flange connections

5.2.3 Flange connections having components sensitive to heat, including gaskets or isolation kits, are not to be used in spaces where leakage or failure caused by fire could result in fire spread, flooding or loss of a Mobility or Ship Type system.

Existing paragraph 5.2.3 has been renumbered 5.2.4.

Volume 2, Part 7,
Chapter 2
Ship Piping Systems

■ *Section 10*
Air, overflow and sounding pipes

10.10 Sounding arrangements

10.10.3 Where fitted, sounding pipes are to be as straight as practicable~~;~~, and if curved to suit the structure of the ship, the curvature must be sufficiently easy to permit the ready passage of the sounding rod or chain.

10.10.4 Sounding devices of approved type may be used in lieu of sounding pipes for sounding tanks subject to the following conditions:~~.~~ ~~These devices are to be tested, after fitting on board, to the satisfaction of the Surveyors.~~

(a) Gauge glasses of any type are not to be used on oil fuel tanks or tanks integral to the ships structure.
(b) Sounding devices used on oil fuel tanks or tanks integral to the ship's structure are not to require penetrations below the top of the tank.
(c) These devices are to be tested, after fitting on board, to the satisfaction of the Surveyors.

10.10.5 Where gauge glasses are used for indicating the level of liquid in tanks containing lubricating oil, hydraulic oil ~~fuel oil~~ or other flammable liquid, the glasses are to be of the flat type of heat-resisting quality, adequately protected from mechanical damage, and fitted with self-closing valves at the lower ends and at the top ends if these are connected to the tanks below the maximum liquid level. The arrangement may incorporate a single point of operation for the valves.

Volume 2, Part 7,
Chapter 3
Machinery Piping Systems

■ *Section 9*
Control, supervision and monitoring of equipment

9.3 Thermal fluid heaters

(Part only shown)

Table 3.9.1 Thermal fluid heaters: Alarms and safeguards

Item	Alarm	Note
Igniter power supply*	Failure	Each igniter to be checked before fuel oil is supplied to burner, *see Vol 2, Pt 7, Ch 3, 9.3 Thermal fluid heaters 9.3.5* and Note 3

9.3.5 Burner fuel oil valve(s) are not to open:

- prior to completion of required warm up times; or
- when the power supply to the igniter has failed; or

- until a pilot flame is established, as applicable; or
- prior to the completion of furnace purging, *see Vol 2, Pt 7, Ch 3, 3.1 Oil burning units 3.1.9*.

Volume 2, Part 7,
Chapter 5
Ship Type Piping Systems

■ *Section 2*
Construction and installation

2.1 Materials

2.1.3 Materials sensitive to heat, such as aluminium,~~ or~~ plastics, or elastomers, are ~~in general~~ not to be used for Ship Type piping systems~~. Such materials are not in any event to be used in systems containing flammable liquids or sea-water~~ where leakage or failure caused by fire could result in fire spread, flooding or loss of the system~~ or in the flooding of watertight compartments~~. They may be permitted, where necessary, for signature or shock purposes, in which cases they are to have suitable fire certification. ~~*See Vol 2, Pt 7, Ch 1 Piping Design Requirements* for plastic pipes.~~

Volume 2, Part 8,
Chapter 1
Steam Raising Plant and Associated Pressure Vessels

■ *Section 18*
Control and monitoring

18.2 Automatic and remote controls

(Part only shown)

18.2.7 Burner fuel oil valve(s) are not to open:

- prior to completion of required warm up times; or
- when the power supply to the igniter has failed; or
- until a pilot flame is established, as applicable; or
- prior to the completion of furnace purging, *see Vol 2, Pt 7, Ch 3, 3.1 Oil burning units 3.1.9*.

Table 1.18.1 Boilers: Alarms and safeguards

Item	Alarm	Note
Igniter power supply*	Failure	Each igniter to be checked before fuel oil is supplied to burner(s), *see Vol 2, Pt 8, Ch 1, 18.2 Automatic and remote control 18.2.7* and ~~see~~ Note 5

Volume 2, Part 9,
Chapter 1
General Requirements for the Design and Construction of Electrotechnical Systems

■ *Section 1*
General requirements

1.4 Documentation required for design review

(Part only shown)

1.4.5 A System Operational Concept of the electrical power system which details the capability and functionality under defined operating and emergency conditions is to be submitted, *see Vol 1, Pt 1, Ch 2, 2.2 Definitions*. The System Operational Concept is to be agreed between the designers and Owners and is to include:

(b) an earthing philosophy document that defines the basic approach to be taken for earthing the electrical power systems and all electrical loads; ~~and~~

(d) the quality of power supplies required for each designated load, where this is required by *Vol 2, Pt 9, Ch 1, 2.1 Quality of power supplies (QPS) 2.1.3*~~.~~;

(e) a functional description for ships with electrical propulsion systems, where harmonic filters are fitted, which includes an operational philosophy of the propulsion control systems under normal, reasonably foreseeable abnormal and degraded modes of operation;

(f) harmonic filters where fitted, including harmonic analysis, the permitted modes of operation for maintaining the harmonic distortion within acceptable limits, and the effect on harmonic distortion of the failure of any combination of harmonic filters, *see also Vol 2, Pt 9, Ch 1, 2.1 Quality of power supplies (QPS) 2.1.3* and *Vol 2, Pt 9, Ch 1, 2.1 Quality of power supplies (QPS) 2.1.4*; and

(g) guidance indicating the safe operating modes of the electrical power system under both normal and failure conditions of the harmonic filters where fitted.

(Part only shown)

1.4.11 Simplified circuit diagram of electrical propulsion system (where fitted) giving details of:

(h) harmonic filters and analysis.

■ *Section 2*
System level requirements

2.1 Quality of power supplies (QPS)

2.1.3 ~~**Harmonics.**~~ Unless specified otherwise, the total harmonic distortion (THD) of the voltage waveform at any a.c switchboard or section-board is not to exceed 8 per cent of the fundamental for all frequencies up to 50 times the supply frequency and no voltage at a frequency above 25 times supply frequency is to exceed 1,5 per cent of the fundamental of the supply voltage. THD is the ratio of the rms value of the harmonic content to the rms value of the fundamental, expressed in per cent and may be calculated using the expression:

$$THD = \frac{\sqrt{\sum_{h=2}^{\infty} V_h^2}}{V_1} \times 100$$

where

V_h = rms amplitude of a harmonic voltage of order h

V_1 = rms amplitude of the fundamental voltage.

2.1.4 Where a higher value of THD is specified, all installed equipment and systems are to be designed for the higher specified limit. This relaxation on the limit is to be documented in the harmonic distortion calculation report.

Existing paragraphs 2.1.4 to 2.1.6 have been renumbered 2.1.5 to 2.1.7.

Volume 2, Part 9,
Chapter 3
Electrical Power Distribution and Equipment

■ *Section 4*
Supply and distribution

4.10 Harmonic distortion measurement

4.10.1 The requirements of *Vol 2, Pt 9, Ch 3, 4.10 Harmonic distortion measurement* apply to electrical distribution systems that include harmonic filters. This requirement applies both to high voltage and low voltage busbars. *See also Vol 2, Pt 9, Ch 4, 4.13 Harmonic filters*. Harmonic filters associated with frequency drives for individual applications (i.e. pump motors) are excluded from the following requirements.

4.10.2 Means are to be provided to continuously monitor the levels of harmonic distortion experienced on the main busbars and to operate an alarm in the engine control room, or equivalent attended position, in the event that the harmonic distortion exceeds the acceptable limits, *see also Vol 2, Pt 9, Ch 1, 4.2 Alarm system for machinery.*

4.10.3 Where the engine room is provided with automation systems to continuously monitor the levels of harmonic distortion experienced on the main busbar(s), this reading is to be logged electronically; otherwise it is to be measured annually and after any modification to the ship electrical distribution system or associated consumers, and is to be recorded in the engine log book for future inspection by the Surveyor.

4.11 Harmonic filtering

4.11.1 The requirements in this Section apply to systems provided with harmonic filters. They apply in particular to, but are not limited to, electrical propulsion systems and are in addition to the requirements for harmonic filters in *Vol 2, Pt 9, Ch 4, 4.13 Harmonic filters.*

4.11.2 Filters used to control harmonic distortion are to keep the distortion within acceptable limits at the main supply. *See also Vol 2, Pt 9, Ch 1, 2.1 Quality of power supplies.*

4.11.3 The service life of the harmonic filter is to be declared, and details are to be included in the harmonic calculation report.

4.11.4 The temperature rating of the harmonic filter is to allow for the increased heating effect of the harmonic distortion.

4.11.5 The construction of cabinets for harmonic filters shall be in accordance with the standards for main switchboards, where applicable. *See also Vol 2, Pt 9, Ch 3, 5 Switchgear and controlgear assemblies*.

4.11.6 The modes of operation of the electrical distribution system for which harmonic distortion levels at the main switchboard busbars are maintained within the acceptable limits during normal operation are to be defined by the system integrator.

4.11.7 Harmonic distortion calculations are to include levels of harmonic distortion expected in normal operation and in the event of a failure of a harmonic filter or the failure of any combination of harmonic filters. *See also Vol 2, Pt 9, Ch 11, 21.2 Trials.*

■ *Section 6*
Rotating machines – general requirements and motors

6.1 General requirements

6.1.11 For high voltage machines, the stator insulation system is to be of a type that has undergone ~~type~~ design qualification testing in accordance with the applicable requirements of the following International Standards, or relevant alternatives acceptable to LR, to demonstrate its suitability for the operating voltage:

(a) IEC 60034-18-31, *Rotating electrical machines – Part 18-31: Functional evaluation of insulation systems – Test procedures for form-wound windings – Thermal evaluation and classification of insulation systems used in rotating machines*;
(b) IEC 60034-18-32, *Rotating electrical machines – Part 18-32: Functional evaluation of insulation systems – Test procedures for form-wound windings – Evaluation by electrical endurance*;
~~(c) IEC TS 60034-18-33 *Rotating electrical machines – Part 18-33: Functional evaluation of insulation systems – Test procedures for form-wound windings– Multifactor evaluation by endurance under simultaneous thermal and electrical stresses*;~~
~~(d)~~(c) IEC 60034-18-34, *Rotating electrical machines – Part 18-34: Functional evaluation of insulation systems – Test procedures for form-wound windings – Evaluation of thermomechanical endurance of insulation systems*;
~~(e)~~(d) IEC 60034-27-3, *Dielectric dissipation factor measurement on stator winding insulation of rotating electrical machines*.

Test samples are to be representative in terms of the number and size of conductors, coil construction~~,~~ and the combination of materials and manufacturing process.

6.1.17 The completed stator of high voltage rotating machines to be used for ship type and mobility systems is to be tested for partial discharge in accordance *with IEC 60034-27-1, Rotating electrical machines Part 27-1: Off-line partial discharge measurements on the winding insulation* or an alternative standard acceptable to LR. Copies of the test reports are to be provided to the Surveyor on request.

6.1.18 For high voltage rotating machines to be used for ship type or mobility systems, suitable access is to be provided which will enable visual inspections of the stator and field windings for signs of damage. Boroscopic and/or endoscopic inspection techniques may be used where appropriate. Areas to be capable of inspection are to include, but are not limited to:
- drive and non-drive ends of the machine;
- stator/core: core laminations, stator wedges, stator bars, space blocks, end windings and connection rings, flux shield and instrumentation;
- field/frame: field wedges, retaining ring and coil end turns.

6.1.19 Where the requirements of *V2, Pt 9, Ch 3, General requirements paragraph 6.1.18* cannot be achieved, a means of connecting partial discharge monitoring equipment is to be installed. The means of connection is to enable through-life testing in accordance with the recommendations of the rotating machine manufacturer and *IEC 60034-27-1, Rotating electrical machines Part 27-1: Off-line partial discharge measurements on the winding insulation* or an alternative standard acceptable to LR. Alternatively, the requirements of *V2, Pt 9, Ch 3, General requirements paragraph 6.1.20 may be applied.*

6.1.20 Where it is intended to install on-line partial discharge monitoring equipment, the high voltage rotating machine installation is to be provided with a means of connection which will enable the safe connection of the equipment once the rotating machine is in service. The means of connection is to enable through-life testing in accordance with the recommendations of the rotating machine manufacturer and one of the following standards:
(a) on-line testing:
  - PD IEC/TS 60034-27-2 *Rotating electrical machines Part 27-2: On-line partial discharge measurements on the stator winding insulation of rotating electrical machines*;
  - DD IEC/TS 61934, *Electrical insulating materials and systems — Electrical measurement of partial discharges (PD) under short rise time and repetitive voltage impulses*; or

(b) an alternative International or National Standard acceptable to LR.

Existing paragraph 6.1.17 has been renumbered 6.1.21.

Volume 2, Part 9, Chapter 4 Electrical Protection

■ *Section 4*
System design – protection

4.13 Harmonic filters

4.13.1 Harmonic filters' final sub-circuits are to be protected individually and individually on each phase against overload and short-circuit. The activation of the protection arrangement in a single phase shall result in automatic disconnection of the complete filter.

4.13.2 A current imbalance detection system is to be installed; it is to be independent from the protection specified in *Vol 2, Pt 9, Ch 4, 4.13 Harmonic filters 4.13.1*.

4.13.3 An alarm is to be initiated in the event of protective device operation or current unbalance that could lead to failure of harmonic filter.

~~4.13.3 Where parallel harmonic filters are used:~~
~~(a) an alarm is to be initiated in the event of current imbalance that could lead to failure of a harmonic filter.~~
~~(b) current imbalance circuits are to 'fail safe'; and~~
~~(c) The restarting of harmonic filters is to require manual intervention.~~

4.13.4 Current imbalance circuits are to be 'fail safe'. The characteristics of the 'fail safe' operation are to be evaluated not only on the basis of the system and its associated machinery, but also the complete installation, as well as of the ship.

4.13.5 The reconnection of harmonic filters is to require manual intervention.

4.13.6 Individual harmonic filter capacitors are to be provided with a pressure relief valve or overpressure disconnector to protect against damage from rupture where pressure build-up within hermetically sealed capacitors may occur.

Volume 2, Part 9,
Chapter 12
Testing and Trials

■ *Section 1*
Testing and trials

1.2 Trials

(*Part only shown*)

1.2.7 It is to be demonstrated that the Rules have been complied with in respect of:

(f) harmonic distortion of the voltage waveform~~, where declared;~~. Where harmonic filters are installed, the calculation results provided by the system integrator are to be verified by the Surveyor. Simulations in trials of harmonic filter failure that would result in THD levels calculated to be higher than the acceptable limit are to be avoided. *See Vol 2, Pt 9, Ch 3, 4.11 Harmonic filtering;*

(j) the operation of the propulsion system with the harmonic filter removed from circuit is to be verified in accordance with the design intent, *see* ~~*Vol 2, Pt 4, Ch 5, 4.6 Protection of propulsion system 4.6.4*. Any~~ *Vol 2, Pt 4, Ch 5, 4.5 Harmonic filtering for propulsion 4.5.2*; any operational and functional limitations are to be documented and details retained on board; and

1.4 ~~Partial~~ On-line partial discharge testing of high voltage rotating machines for ship type and mobility systems

~~1.4.1 To enable future trend analysis, on completion of harbour acceptance trials or during sea acceptance trials, partial discharge measurements are to be conducted which will baseline the partial discharge characteristics of the rotating machine. A copy of the test report is to be retained on board and made available to the Surveyor on request.~~

~~1.4.2 At the first Annual Survey, or within 3 months of the due date, the partial discharge measurements required by*Vol 2, Pt 9, Ch 11, 1.4 Partial discharge testing of high voltage rotating machines for ship type and mobility systems 1.4.1* are to be repeated. A copy of the test report is to be retained on board and made available to the Surveyor on request.~~

~~1.4.3 At Complete Survey or, within 3 months of the due date, the partial discharge measurements required by *Vol 2, Pt 9, Ch 11, 1.4 Partial discharge testing of high voltage rotating machines for ship type and mobility systems 1.4.1* are to be repeated. A copy of the test report is to be retained on board and made available to the Surveyor on request.~~

~~1.4.4 The partial discharge measurement method to be used is to be acceptable to the rotating machine manufacturer. Particular attention is to be given to ensuring:~~

~~(a) the test voltage and frequency (i.e. ac, dc or ultra-low frequency and voltage level), and method selected are to be compatible with the insulation systems; and~~

~~(b) the tests do not over stress or cause accelerated aging of the insulation system.~~

~~1.4.5 The measurements required by *Vol 2, Pt 9, Ch 11, 1.4 Partial discharge testing of high voltage rotating machines for ship type and mobility systems 1.4.1* to *Vol 2, Pt 9, Ch 11, 1.4 Partial discharge testing of high voltage rotating machines for ship type and mobility systems 1.4.3* are to be conducted and recorded in accordance with one of the following standards as appropriate to the design and application of the rotating machine:~~

- ~~IEC TS 60034-27, *Rotating electrical machines – Part 27: Off-line partial discharge measurements on the stator winding insulation of rotating electrical machine*;~~
- ~~PD IEC/TS 60034-27-2:2012, *Rotating electrical machines – Part 27-2: On-line partial discharge measurements on the stator winding insulation of rotating electrical machines*;~~
- ~~DD IEC/TS 61934:2011, *Electrical insulating materials and systems – Electrical measurement of partial discharges (PD) under short rise time and repetitive voltage impulses*; or~~
- ~~an alternative relevant National Standard acceptable to LR.~~

~~1.4.6 The test report required by *Vol 2, Pt 9, Ch 11, 1.4 Partial discharge testing of high voltage rotating machines for ship type and mobility systems 1.4.1* to *Vol 2, Pt 9, Ch 11, 1.4 Partial discharge testing of high voltage rotating machines for ship type and*~~

~~*mobility systems 1.4.3* is to record the method and equipment used in sufficient detail to ensure the tests can be repeated consistently throughout the service life of the rotating machine.~~

~~1.4.7 The test report required by *Vol 2, Pt 9, Ch 11, 1.4 Partial discharge testing of high voltage rotating machines for ship type and mobility systems 1.4.6* is to include, but not be limited to, the details recommended by the test standard to be applied (*see Vol 2, Pt 9, Ch 11, 1.4 Partial discharge testing of high voltage rotating machines for ship type and mobility systems 1.4.5*).~~

~~1.4.8 The documentation required by *Vol 2, Pt 9, Ch 11, 1.4 Partial discharge testing of high voltage rotating machines for ship type and mobility systems 1.4.6* is to be provided to the end user as part of the as-built documentation for the rotating machine.~~

~~1.4.9 Partial discharge measurements are to evaluated by suitably qualified and experienced personnel, and are to remain within the manufacturers' recommendations.~~

~~1.4.10 Where partial discharge measurements exceed the manufacturer's recommendations corrective action is to be taken.~~

~~1.4.11 Where on line partial discharge monitoring equipment is installed, which is capable of being used to alert the ship's staff of an increase in partial discharge activity, the output is to be included as an alert, with alert levels set and the actions required to be specified by the manufacturer of the rotating machine~~

Existing sub-Section 1.4 has been deleted and replaced with the following:

1.4.1 Where on-line partial discharge monitoring equipment is installed for the monitoring of high voltage rotating machines used to provide ship type and mobility systems, the method used is to be appropriate for the design and application of the rotating machine, and conducted and recorded in accordance with:

(a) PD IEC/TS 60034-27-2:2012, *Rotating electrical machines Part 27-2: On-line partial discharge measurements on the stator winding insulation of rotating electrical machines*;
(b) DD IEC/TS 61934:2011, *Electrical insulating materials and systems – Electrical measurement of partial discharges (PD) under short rise time and repetitive voltage impulses*; or
(c) an alternative International or National Standard acceptable to LR.

1.4.2 The partial discharge measurement method used is to be acceptable to the rotating machine manufacturer. Particular attention is to be given to ensuring that:

- the test voltage and frequency (i.e. a.c., or ultra-low frequency and voltage level) and method selected are to be compatible with the insulation systems; and
- the tests do not over stress or cause accelerated ageing of the insulation system.

1.4.3 The test reports required by *Vol 2, Pt 9, Ch 12, 1.4 On-line partial discharge testing of high voltage rotating machines ship type and mobility systems 1.4.1* are to:

- record the method and equipment used in sufficient detail to ensure the tests can be repeated consistently throughout the service life of the rotating machine; and
- include, but are not limited to, the details recommended by the test standard to be applied.

1.4.4 Where partial discharge monitoring equipment has been installed in accordance with *Vol 2, Pt 9, Ch 12, 1.4 On-line partial discharge testing of high voltage rotating machines for ship type and mobility systems 1.4.1* to enable through-life trend analysis:

(a) measurements are to be recorded at harbour acceptance trials or sea trials to baseline the partial discharge characteristics of the rotating machine, and then repeated annually; and
(b) a copy of the test reports and data is to be retained on board and made available to the Surveyor on request.

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